

**Description of *Amphiascoides atopus*, a new species  
(Crustacea: Copepoda: Harpacticoida) from  
a mass culture system**

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*Abstract.*—*Amphiascoides atopus*, a new species, is described from a mass culture system. Its natural habitats and distribution are unknown. This new species shares the possession of seven setae on the exopod 3 of leg 4 with ten other species in the genus. *Amphiascoides atopus* can be distinguished from congeneric species by the shape, relative length, and ornamentation of the setae on the leg 5 in both male and female. Possession of three setae grouped together on the proximal region of the second endopod segment of leg 2 distinguishes the males of this species from all other described males in this genus.

A species of harpacticoid copepod has been successfully kept in a mass culture system in our laboratory at the Department of Zoology and Physiology, Louisiana State University, Baton Rouge, LA. Approximately 300,000 individuals have been harvested from 2.5 m<sup>2</sup> culture surface area almost every day for more than six months, with no sign of population decline. Specimens used to start this culture were obtained from a commercial bioassay laboratory, where it was identified as a fouling species in culture tanks of marine fish and invertebrates. It was identified as an undescribed species of *Amphiascoides*. It was not possible to determine the source of the individuals present in the tanks as the origin of the various specimens was from many localities in the United States including other laboratories. Therefore, the natural habitat and the distribution of this new taxon remain unknown. In the United States three species of *Amphiascoides* (*A. lancisetiger* Lang, 1965, *A. petkovskii* Lang, 1965, *A. dimorphus* Lang, 1965) have been described from the coast of California and were collected from tidal pools, shell-sand intertidal, among algae and among stones (Lang

1965). On the Atlantic coast, the cosmopolitan *A. debilis* has been recorded from Scituate, MA living among algae by Rosenfield (1967). Specimens in the culture system display strong photophobia and have been successfully cultured in trays containing small stones, suggesting that they might come from the habitats typically reported for *Amphiascoides*. The culture system has been kept at a temperature of 23–26°C and 30‰ salinity.

Specimens examined came directly from our mass culture system. Hundreds of individuals were drawn from the system using a Pasteur pipet and fixed with formalin 4%. Type material was sorted under a stereodissecting microscope. Whole specimens were examined in lactic acid and dissected parts mounted in Hoyers mounting medium. All figures were drawn using a camera lucida connected to a Zeiss microscope. Details were checked on an Olympus BX 50 microscope using phase contrast. Type material and an additional lot of specimens were deposited in the collections of the National Museum of Natural History, Smithsonian Institution. Terminology follows that of Huys & Boxshall (1991).

Order Harpacticoida Sars, 1903  
 Family Diosaccidae Sars, 1906  
 Genus *Amphiascoides* Nicholls, 1941  
*Amphiascoides atopus*, new species  
 Figs. 1-3

*Material.* — Holotype female, ethanol preserved (USNM 259892). Allotype male, ethanol preserved (USNM 259893).

Paratypes: two females dissected and preserved on slides (USNM 259894); two males dissected and preserved on slides (USNM 259898); 10 females (USNM 259895) and 10 males (USNM 259896) ethanol preserved. Additional lot with approximately one hundred adults and copepodites, ethanol preserved (USNM 259897). All specimens were drawn from culture system collections.

*Description of female.* — Length (tip of rostrum to end of caudal rami) of holotype, 841  $\mu\text{m}$ ; paratypes 780–1000  $\mu\text{m}$  ( $n = 10$ ). Body (Fig. 1a) moderately slender, slightly tapering towards the end. Rostrum (Fig. 1b) prominent, with pair of small sensory setae and tip finely serrate. Urosome (Fig. 1c), with ventro-lateral row of spinules on all segments; genital double somite with dorso-lateral sign of subdivision; genital field with attached spermatophore as shown in Fig. 1c; third segment with ventral row of spinules; anal somite with distal border spinulate ventrally; operculum and pseudo-perculum lacking. Caudal rami (Fig. 1d, e) about twice wider than long and bearing short spinules on inner margin; setae II, IV and V well developed; seta II as long as seta VI; seta VII triarticulate; setae II, III, VI and VII naked; seta IV spinulose on outer margin and with few spinules on inner margin, seta V sparsely spinulose on both margins.

Antennule (Fig. 1f). Eight-segmented. Armature as follows: (Roman numeral = segment; Arabic numeral = seta): I—1; II—10; III—5; IV—3 + aesthetasc; V—1; VI—4; VII—2; VIII—6 + aesthetasc.

Antenna (Fig. 1g). Coxa short, aetose.

Allobasis partially divided by an incomplete suture on outer face and with one inner seta. Second endopod segment with two strong spines and row of spinules laterally; distal edge with one spiniform seta, four geniculate setae and one slender seta confluent at base with outermost geniculate seta. Exopod 3-segmented; proximal segment with plumose seta, second segment very short and aetose, terminal segment with one lateral and two apical setae, all pinnate.

Mandibular palp (Fig. 1h). Broad basis with three pinnate and one naked seta on distal edge. Endopod elongate, 2-segmented and with one strong and pinnate basal seta on and two sub-apical setae on first segment and three apical setae on second segment. Exopod 2-segmented, first segment with one basal seta, second segment with three plumose apical setae.

Maxillule (Fig. 1i). Praecoxa with row of spinules medially and at base of coxa; arthrite with two surface setae and seven elements on inner margin, two proximal-most elements ornamented with spinules. Coxa partially fused to basis and lacking epipodite and bearing two setae. Basis with one spinular row, two sub-distal and three distal setae. Exopod with two setae, inner-most pinnate; endopod with three setae, the outer-most pinnate.

Maxilla (Fig. 1j). Syncoxa with spinule rows medially and distally and with three endites, first two bearing two setae and distal endite bearing three setae. Allobasis with distal margin of endite bearing a fused claw and one seta. Endopod 3-segmented with one seta on first two segments and three setae on distal segment.

Maxilliped (Fig. 1k). Well developed and prehensile. Syncoxa with spinule rows and three stout and pinnate setae. Basis with a row of long spinules and two naked setae on inner margin. Endopod 1-segmented with a terminal claw twice as long as the segment and two accessory setae.

Leg 1 (Fig. 2a) with intercoxal sclerite wider than long, without ornamentation;

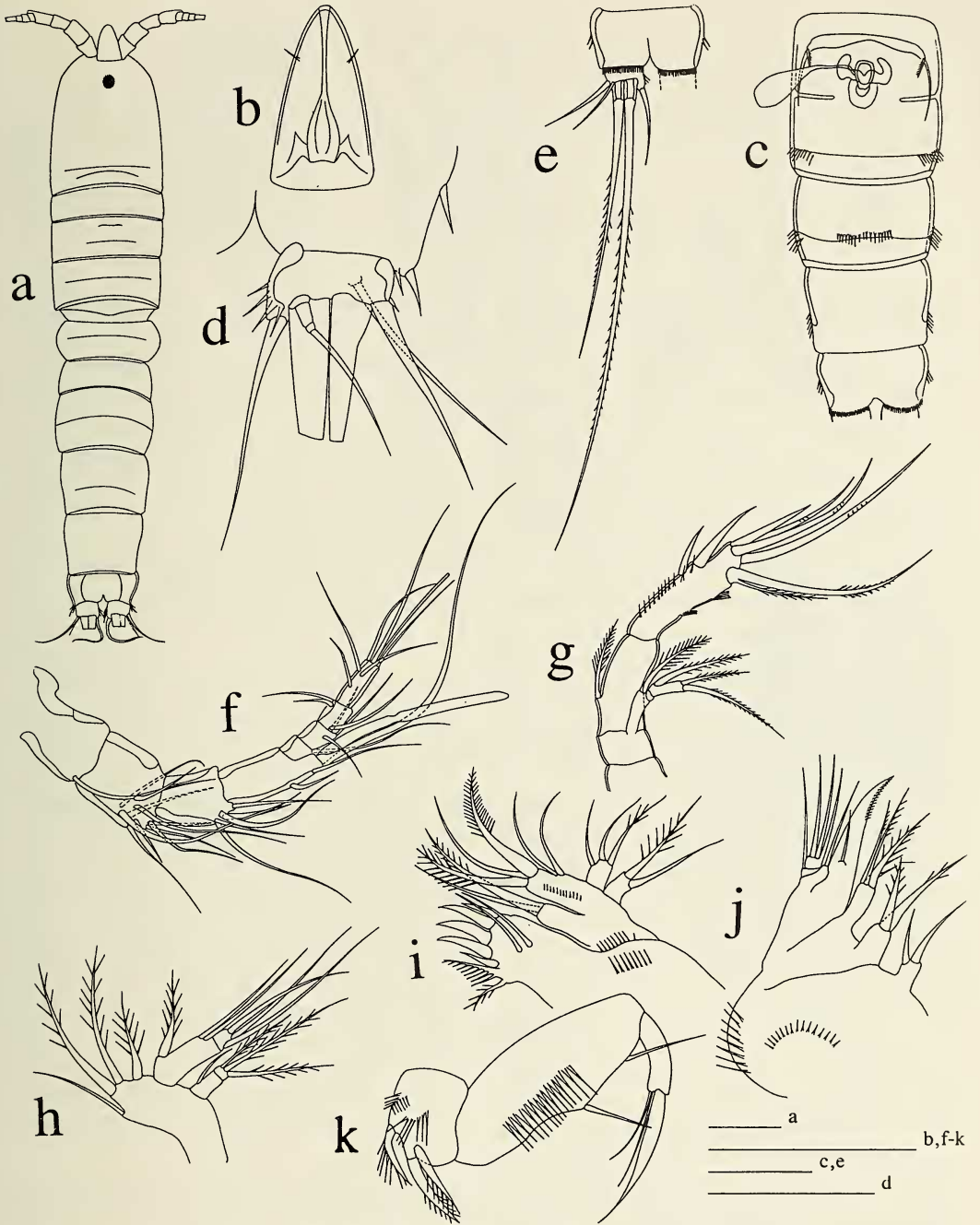


Fig. 1. *Amphascoides atopus*, Female: a. Habitus, dorsal; b. Rostrum; c. Urosome (first somite omitted), ventral; d. Caudal ramus, dorsal; e. Anal somite and caudal ramus, ventral; f. Antennule; g. Antenna; h. Mandibular palp; i. Maxillule; j. Maxilla; k. Maxilliped. Scale bars: a, c, e = 100  $\mu$ m; b, d, f-k = 50  $\mu$ m.



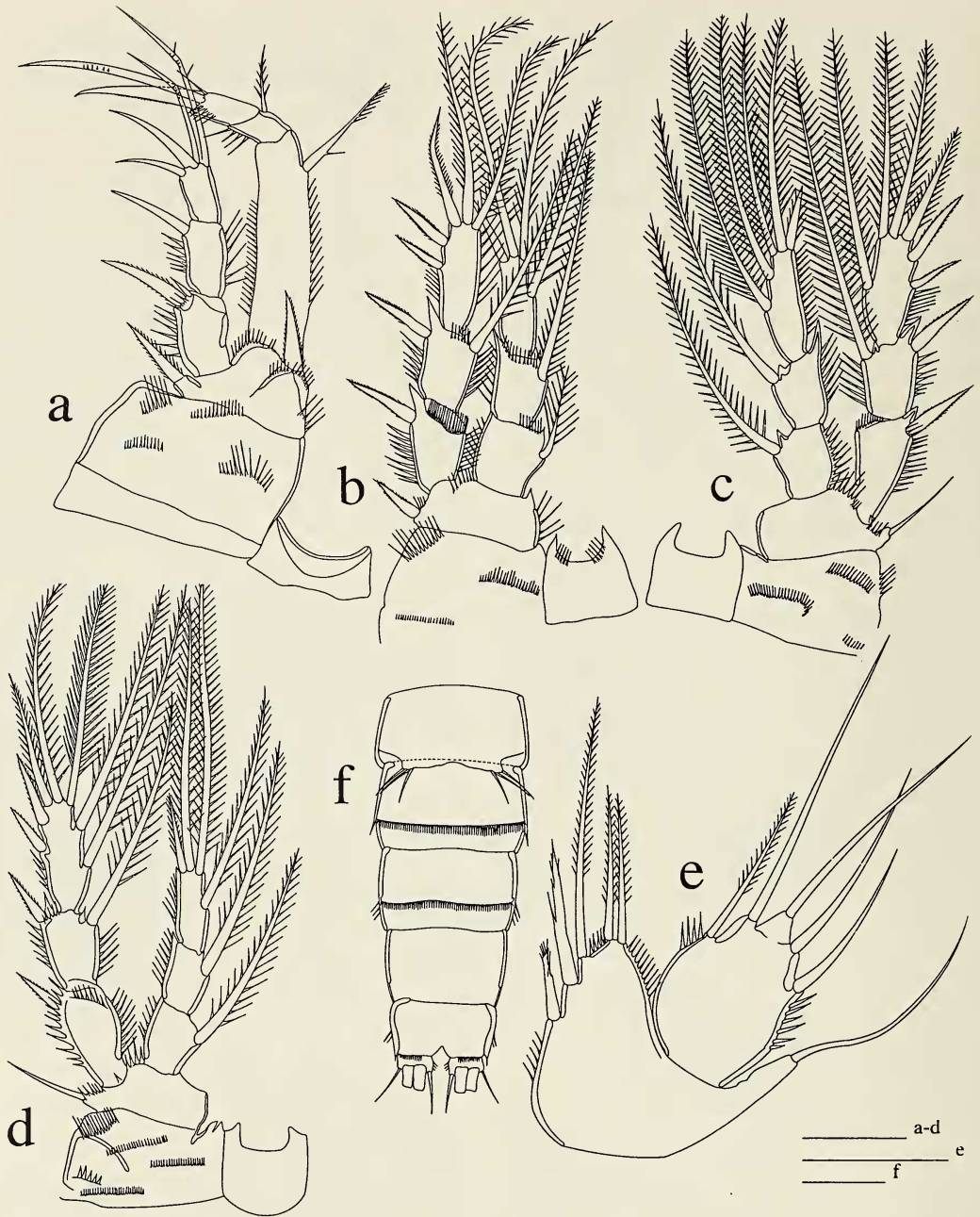


Fig. 2. *Amphiascoides atopus*, Female: a. Leg 1; b. Leg 2; c. Leg 3; d. Leg 4; e. Leg 5. Male: f. Urosome (first somite omitted). Scale bars = 100  $\mu$ m.

coxa with four rows of spinules on anterior face; basis with rows of spinules on inner and distal margin and at base of inner spine; outer seta spiniform and as long as inner

spine, both finely serrate; exopod and endopod 3-segmented; exopod with long spinules present on outer margin of proximal segment and both margins of second seg-

Table 1.—Spine and seta formula for legs 1 to 4.

	Coxa	Basis	Exopod segment			Endopod segment		
			1	2	3	1	2	3
Leg 1	0-0	1-1	I-0; I-0; I,I,2			0-1; 0-1; 0,2,1		
Leg 2	0-0	1-0	I-0; I-1; III,I,1			0-1; 0-1; 1,2,1		
Leg 3	0-0	1-0	I-0; I-1; III,I,2			0-1; 0-1; 1,2,2		
Leg 4	0-0	1-0	I-0; I-1; III,I,3			0-1; 0-1; 1,2,1		

ment; proximal and second segment lacking inner setae; terminal segment with two outer spines and two apical setae; first segment of the endopod reaching beyond the distal margin of the exopod, with spinules on outer and inner margins, and armed with inner seta plumose on inner margin of posterior end; second and third segments spinulose on outer margin; second segment with one plumose seta on inner margin; terminal segment with outer apical seta serrate on outer margin, inner apical seta geniculate and slender inner seta.

Legs 2 to 4 (Fig. 2b–d) with intercoxal sclerite about as long as wide and with spinules only on leg 2. Exopod 3-segmented; outer margin of all segments with a row of spinules; inner row of spinules present on all segments on leg 2, second segment on leg 3, and on first two segments on leg 4; distal margin spinulate on exopod 1 of all legs and exopod 2 leg 2. Endopod 3-segmented and with row of spinules on outer margin of all segments except endopod 3 leg 2; inner and distal margins spinulate only on endopod 1 and 2 leg 2. Spine and seta formula for legs 1 to 4 are shown in Table 1. Setation using system devised by Lang (1934) as follows:

	exopod	endopod
leg 1	0:0:0.2.2	1:1:1.2.0
leg 2	0:1:0.2.3	1:1:1.2.1
leg 3	0:1:1.2.3	1:1:2.2.1
leg 4	0:1:2.2.3	1:1:1.2.1

Leg 5 (Fig. 2e) with baseoendopod and exopod distinct. Baseoendopod with inner expansion reaching about midpoint of ex-

opod, ornamented with a row of spinules and armed with three inner and two apical setae; two innermost setae irregularly spinulate; outer seta naked. Exopod 1.5 times longer than wide, with row of spinules on inner and outer margins and armed with five setae, the innermost pinnate and the remaining naked. Leg 6 (Fig. 1c) represented by two setae, inner seta short and pinnate on inner margin, outer setae long and naked.

*Description of the male.*—Length (tip of rostrum to end of caudal rami) of allotype 828  $\mu\text{m}$ ; paratypes 724–882  $\mu\text{m}$  ( $n = 10$ ). Body similar to the female. Urosome (Fig. 2f) with second and third somites not fused. Third and fourth segments with ventro-lateral row of spinules; anal somite with distal border spinulate ventrally. The male is identical to the female in all other respects.

Antennule (Fig. 3a) 8-segmented, geniculation between sixth and seventh segments. Armature as follows: (Roman numeral = segment; Arabic numeral = seta): I—1; II—8; III—7; IV—7 + spine + aesthetasc; V—1; VI—1 + 2 spines; VII—4; VIII—5 + aesthetasc.

Leg 2 endopod (Fig. 3b) 2-segmented; endopod 1 with row of spinules on outer margin and one short and pinnate seta on midpoint of inner margin. Endopod 2 produced to a strong mucriform projection bearing three setae on inner margin, all grouped together on the proximal region of the segment, above a triangular lateral projection; proximal-most seta the shortest, sparsely spinulose on both margins; median seta the longest, 1.3 times longer than the segment and spinulate on inner margin; distal-most

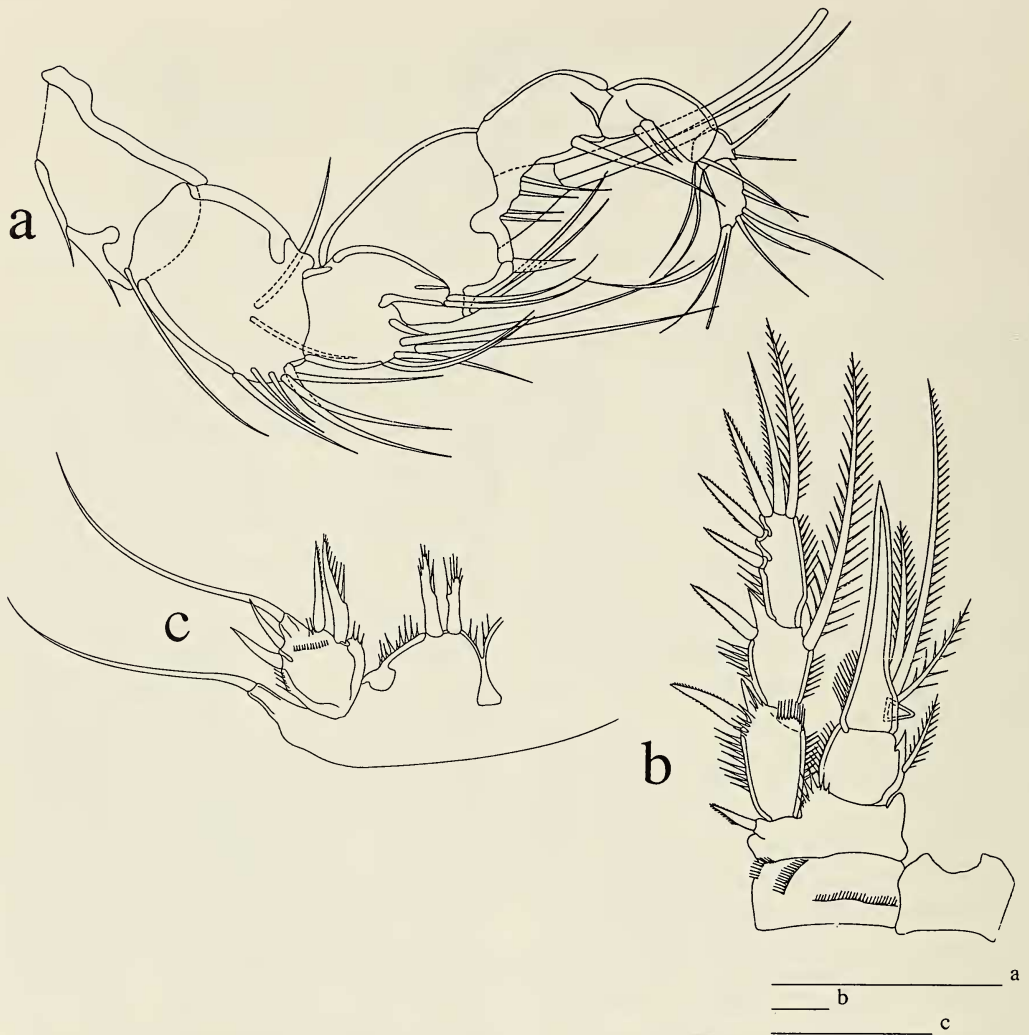


Fig. 3. *Amphascoides atopus*, Male: a. Antennule; b. Leg 2; c. Leg 5. Scale bars = 50  $\mu$ m.

seta the most robust, spinulate on both margins.

Leg 5 (Fig. 3c) with confluent baseopods, not separated by intercoxal sclerite; inner expansion with row of spinules and armed with two irregularly spinulate spines, outermost one slightly longer; outer seta naked and very long. Exopod 1.3 times longer than wide and ornated with minute spinules and bearing five elements; innermost spine the longest, spinulate distally on inner margin; second inner spine minutely pinnate distally on inner margin; middle setae na-

ked and 2.5 times longer than the segment; two outer spines naked and equal in length. Leg 6 (Fig. 2f) represented by three naked setae set on a ventrolateral common plate.

*Distribution.*—Unknown.

*Etymology.*—The specific name is a Neo-Latin formation from Greek *a-* 'without' + *topos-* 'place', used as an adjective with the masculine form *atopus*. It is used as an allusion to the fact that the type material has not been collected from the species natural habitats, as they remain unknown.

*Remarks.*—To the genus *Amphascoides*



belong twenty named species and *Amphiascoides* sp. Becker & Schriver, 1979, from which hitherto only the male has been described. Both males and females of *A. atopus* can be distinguished from the other species of the genus by the shape, relative length and ornamentation of the setae on the leg 5.

*Amphiascoides atopus* shares with *A. brevifurca* (Czernivaski), *A. neglectus* (Norman & T. Scott), *A. subdebilis* (Willey), *A. lancisetiger* Lang, *A. petkovskii* Lang, *A. dimorphus* Lang, *A. nicholli*, *A. bulbiseta* Palares, *A. koltuni* and *A. breviararticulatus* Kunz, the leg 4 exopod three bearing 7 setae. The remaining species in this genus (*A. debilis* (Giesbrecht), *A. dispar* (T. Scott & A. Scott), *A. limicolus* (Brady), *A. littoralis*, *A. nanus* (Sars), *A. nanoides* (Sars), *A. sterilis*, *A. golikovi*, and *A. paradebilis* Tschislenko, have this segment armed with 6 setae. This character is not described for *A. proximus*, a poorly described species that is distinguished from *A. atopus* and all other species in the genus by possessing the baseoendopod leg 5 of the female with only four setae.

Among the species armed with seven setae on the leg 4 exopod 3, *A. brevifurca* differs from *A. atopus* by lacking inner setae on endopod 2 leg 1. *Amphiascoides nicholli* is distinguished from *A. atopus* by having two projections on the tip of the rostrum, leg 1 endopod 1 1.3 times longer than the exopod. *Amphiascoides neglectus* differs from *A. atopus* in having the leg 1 endopod 1 1.4 times longer than the exopod and in the shape of the exopod leg 5, 2.6 times longer than wide. *Amphiascoides subdebilis* is distinguished from *A. atopus* in having the caudal seta VI shorter than seta III, leg 1 endopod 1 1.4 times longer than the exopod. *Amphiascoides lancisetiger*, *A. petkovskii*, and *A. dimorphus*, the three North American species described by Lang (1965), differ from *A. atopus* in having the mandibular exopod 3-segmented and bearing five setae and endopod with seven (*A. lancisetiger*) or eight setae (*A. petkovskii* and *A.*

*dimorphus*), maxillule with four setae on the endopod and 11 (*A. lancisetiger*) or 10 elements (*A. petkovskii* and *A. dimorphus*) on the arthrite, maxilla with 2-segmented endopod, and leg 1 endopod 1 extending far beyond exopod. *Amphiascoides lancisetiger* and *A. petkovskii* further differ from *A. atopus* in having three terminal setae on the distal segment of the antenna exopod. *Amphiascoides bulbiseta* differs from the species here described in having the leg 1 endopod 1 1.5 times longer than the exopod, three terminal setae on the distal segment of the antenna exopod and caudal seta III modified. *Amphiascoides breviararticulatus* differs from *A. atopus* in having three terminal setae on the distal segment of the antenna exopod and inner seta of the leg 6 almost as long as the genital double segment. Finally, *Amphiascoides koltuni* also differs from *A. atopus* in having the leg 1 endopod 1 1.4 times longer than the exopod.

The male of *A. atopus* is readily distinguished from all described males of *Amphiascoides* and from *Amphiascoides* sp. Becker & Schriver, 1979, by the shape and insertion of the setae on the endopod 2 leg 2. This segment is always modified in *Amphiascoides*, but only in *A. atopus* are the three setae grouped together on the proximal region of the segment. In all other species the three setae are inserted on different positions on the inner margin. *Amphiascoides dispar* bears only four setae on the leg 5 exopod in the male, differing in this respect from *A. atopus* and all the other species in the genus. Males are unknown in *A. proximus* (T. Scott), *A. sterilis* (Monard), *A. littoralis* (T. Scott), *A. nicholli* Lang, and *A. golikovi* Tschislenko. The leg 2 is not represented for *A. koltuni* Tschislenko, but it is apparent from the description that it is similar to *A. subdebilis* (Willey).

Morphological data were obtained from Lang (1948) for all species represented in his publication. Data were complemented by Noodt (1955) for *A. brevifurca*; Bodin

(1964), Noodt (1955), and Pallares (1975) for *A. subdebilis*; Tschislenko (1967) for *A. debilis*; Mielke (1974) for *A. nanus*; Becker (1970) for *A. dispar*. Original descriptions were used as the sole source for the remaining species cited.

A mass culture system of *A. atopus* (adult dry weight of 5  $\mu\text{g}$ ) may generate enough copepods to be used in mariculture as a high nutritional value food source for a wide variety of larval fish and shellfish (Sun & Fleeger, pers. comm.). The potential use of *Amphiascoides* as an alternative food source in fish farming has already been suggested in the literature (Walker 1970, Kahan 1979, Shirgur 1989).

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